

TITLE: EFFICIENT PCM MODEM

ABSTRACT OF THE DISCLOSURE

Apparatus and devices used to achieve a computationally efficient modem having a
5 transmit path and a receive path. The apparatuses include a Farrow phase shifter for shifting
the phase of signals in the transmit path, a fractionally spaced equalizer capable of
equalization and signal decimation in the receive path, a primary echo sub-canceler and a
post equalizer echo canceler for canceling echoes on the receive path, and a phase locked
10 loop and add/delete register for controlling the sampling rate of a CODEC. The method
includes shifting the phase of a transmit signal using a Farrow structure, equalizing and
decimating a receive signal with a fractionally spaced equalizer, canceling primary echoes on
the receive signal using a sub-canceler structure and canceling remaining echoes using a post
equalizer echo canceler, and adjusting the sampling rate of a CODEC using a phase locked
15 loop and an add/delete register.